GUJARAT TECHNOLOGICAL UNIVERSITY

POWER ELECTRONICS & ELECTRICAL DRIVES (45)

POWER ELECTRONICS-I

SUBJECT CODE: 2714501

M.E. 1st SEMESTER

Type of course: Engineering Science **(ELECTRICAL)**

Prerequisite: N.A.

Rationale: N.A.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
4	0	2#	5	70	30	20	10	10	10	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	**REVIEW OF POWER SEMICONDUCTOR DEVICES** Review of Power semiconductor devices, Gate and Base drive circuits, Preliminary design considerations, Temperature control of power devices, Heat sink design, and Design of Magnetic components.	8	20
2	**DC - DC CONVERTERS** Buck converter, Boost converter, Buck−Boost converters, CUK converter, Fly-back converter, Forward converter, Push−pull converter, Full bridge and Half bridge converters, Design considerations and comparison	10	25
3	**INVERTERS** Review of single phase bridge inverters, 3-phase bridge inverters, Pulse width modulated inverters, 1-pulseand multi pulse modulation, Sinusoidal PWM, Space Vector PWM, Reduction of harmonics Selective Harmonic Elimination Technique.	10	25
4	**LINE COMMUTATED CONVERTERS** Principle of phase control, Review of single phase converters, 3 phase half and fully controlled converters, 12−pulse converter, Dual converters.	6	15
5	**AC VOLTAGE CONTROLLERS** Single phase AC voltage controllers, 3−phase AC voltage controllers.	6	15

Reference Books:

1. Rashid, M. H., "Power Electronics Circuits, Devices, and Applications, Prentice-Hall of India Pvt. Ltd., New Delhi, 2nd edition, 1999.
2. M.D. Singh and K.B. Khanchandani, “Power Electronics”, Tata McGraw-Hill Education, Second Edition
3. M.S. Jamil Asghar, “Power Electronics”, PHI Learnig Private Ltd, New Delhi, 2009.

4. P.C Sen. “Thyristor DC Drives”, John wiely and sons, New York, 1981.
5. B. K. Bose – Power Electronics& AC Drives Prentice-Hall, New Jersey.
6. S. Sivanagaraju, “Power Electronics”, PHI Learnig Private Ltd, New Delhi, 2010.
7. Recent IEEE publication &transactions on power electronics, industry applications and power delivery.

Course Outcomes:

After learning the course the students should be able to:

1. Utilize the basic concepts of power semiconductor devices and its switching characteristics for selecting device which is best suited for specific application.
2. design magnetic components required in power converter.
3. Compare the performance of different topologies of DC-DC converters.
4. Compare the different PWM techniques for Operation of Inverter.
5. Understand the working and use of Line commutated converters.
6. Analyze the performance of different types of AC voltage controllers

List of Experiments:

1. To perform and analyze the output characteristic and transfer characteristic of power electronic devices (MOSFET/IGBT/SCRs)
2. To perform and analyze the operation of DC-DC converters (buck, boost and/or buck-boost) with continuous and discontinuous modes of operation
3. To perform and analyze the operation of Flyback converter
4. To perform and analyze the operation of Forward converter
5. To perform and analyze the operation of Push-pull converter
6. To perform and analyze single phase AC voltage controller with R and RL load
7. To perform and analyze three phase AC voltage controller with star and delta connected load
8. To perform and analyze the operation of single phase full-bridge inverter with R and RL load for the different types of PWM technique.
   square wave
   Square PWM
   Sin PWM &
   SVPWM technique
9. To perform and analyze three phase inverter with 120° and 180° mode of operations.
10. To simulate full bridge single phase inverter.
11. To simulate full bridge inverter with unipolar as well as bipolar SPWM.
12. To simulate buck converter.
13. To simulate buck-boost converter.
14. To simulate cuk converter.
15. To simulate full bridge push-pull converter.
16. To simulate three phase AC voltage controller.
17. To simulate full bridge inverter with selective harmonic reduction technique.

Open Ended Problems:

Major Equipments:

The necessary Kits, Breadboard, equipments, accessories and instruments are to be provided to conduct the above practical in a group of maximum four students.

List of Open Source Software/learning website:

Psim (Demo/full version): Software is helpful in simulating electronics circuits.

MATLAB: Software is helpful for modeling, simulation and analysis.